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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/628,629
Filing Date	July 31, 2000
First Named Inventor	Suhail S. Saquib
Art Unit	2623
Examiner Name	A. P. Bhatnagar
Attorney Docket Number	8445
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
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- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
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Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	POLAROID CORPORATION		
Signature	*[signature]*		
Printed name	Gaetano D. Maccarone		
Date	March 3, 2006	Reg. No.	25,173

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Signature	*[signature]*		
Typed or printed name	Gaetano D. Maccarone	Date	March 3, 2006

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PTO/SB/17 (01-06)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($) 500.00

Complete if Known	
Application Number	09/628,629
Filing Date	July 31, 2000
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1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims ____ - 20 or HP = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims ____ - 3 or HP = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims — **Fee ($)** ____ **Fee Paid ($)** ____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = **Extra Sheets** ____ / 50 = **Number of each additional 50 or fraction thereof** ____ (round **up** to a whole number) x **Fee ($)** ____ = **Fee Paid ($)** ____

4. OTHER FEE(S) — **Fees Paid ($)**

Non-English Specification, $130 fee (no small entity discount) ____

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SUBMITTED BY			
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Name (Print/Type)	Gaetano D. Maccarone		Date March 3, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 09/628,629 Confirmation No.: 3888
Appellant : Suhail S. Saquib
Filed : July 31, 2000
Title : ALIASING ARTIFACT ATTENUATION SYSTEM
TC/A.U. : 2623
Examiner : A.P. Bhatnagar

Docket No. : 8445
Customer No.: 20349

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

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Sir:

This is appellant's Appeal Brief in the appeal taken from the final rejection of claims 1 - 49 of the application as set forth in the Office Action, made final, mailed October 6, 2005.

This is the second Appeal Brief filed by appellant in this application. Previously during prosecution, on January 14, 2005, appellant filed a first Appeal Brief in response to a first Final Rejection. The USPTO then re-opened and new grounds of rejection based on different references were asserted against the claims.

Subsequently the USPTO issued a second Final Rejection. This Appeal Brief is responsive to the second Final rejection.

REAL PARTY IN INTEREST

The real party in interest in this appeal is Polaroid Corporation, a corporation organized and existing under the laws of the State of Delaware, of 1265 Main Street, Waltham, MA 02451.

RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

STATUS OF CLAIMS

1. Claims 1 - 3, 5 - 7, 12, 20 - 22, 24 - 26, 35 - 37 and 39 - 41 have been rejected as being unpatentable over the references applied in support of the rejection.

2. Claims 13 - 19, 30 - 34 and 45 - 49 have been allowed.

3. Claims 4, 8 - 11, 23, 27 - 29, 38 and 42 - 44 have been objected to as being dependent upon a rejected base claim but as being allowable if rewritten in independent form.

STATUS OF AMENDMENTS

Appellant did not file an amendment after the final Office action and elects to prosecute this appeal on the basis of the claims which were in the application prior to the final Office Action.

SUMMARY OF INVENTION

Appellant's claims are directed to a method and apparatus for selective attenuation, or removal, of corruption, or aliasing artifacts, in a digital signal. Corruption can be introduced into a digital signal by the phenomenon known as "aliasing". For a discussion of this phenomenon see page 4, lines 21 - 25 of the application. In particular, appellant's method is

designed to attenuate aliasing artifacts that occur in digital images captured with a sensor that does not have a suitable anti-aliasing filter. See the discussion extending from page 5, line 12 to page 6, line 5. In appellant's method the output signal is devoid of any aliasing artifacts which were already present in the input signal.

In the claimed method the resolution of the digital input signal is first reduced to provide a reduced resolution signal that has fewer data samples, or points, than the input signal. The reduced resolution signal is then median filtered, i.e., for any one sample in the reduced resolution signal the median filter computes the median of its neighboring *n* samples and replaces the sample value with the median value, to provide a filtered reduced resolution signal. It is well known in the art that a median filter is a <u>non-linear</u> filter.

The filtered reduced resolution signal is then interpolated, that is, the number of data points is increased, to provide the digital output signal.

The process of decimation and interpolation reduces the computational complexity involved in the claimed method. See, for example, the discussion on page 17, lines 3 - 14.

REFERENCES APPLIED BY THE USPTO

1. U.S. Patent No. 6,337,645 B1 ("Pflaumer").

2. U.S. Patent No. 5,148,278 ("Wischermann").

3. U.S. Patent No. 5,623,317 ("Robinson et al.").

DISCUSSION OF THE REFERENCES

1. Pflaumer is directed to audio signal processing and utilizes a linear filter. The key problem to which the method of Pflaumer is directed is distortion which arises in an audio signal from the fact that new frequencies are created above the original Nyquist frequency due to interpolation or up-sampling (see column 2, lines 5 - 18). This is in contrast to the artifacts dealt with in the method of appellant which, as discussed above, arise when the sampling rate of a signal is reduced due to decimation, or down-sampling, without the removal of high frequencies above the Nyquist frequency and these high frequencies "alias" to low frequencies.

2. Wischermann is directed to filtering video signals, which are three dimensional signals, to "... suppress disturbing signals which occur most often in video signals that are received from a television

broadcast or by reproduction from video tape or other records" (see column 1, line 67 to column 2, line 2). There is described a three dimensional, non-linear filter for this purpose.

3. Robinson et al. describes a method and apparatus for combining video signals with key signals while maintaining the integrity of the video signal and minimizing the effect of alias components.

ISSUES

A. Whether the subject matter of claims 1, 20 and 35 is unpatentable under 35 USC § 103(a) as being obvious over Pflaumer and Wischermann.

B. Whether the subject matter of claims 2, 3, 5 - 7, 12, 21, 22, 24 - 26, 36, 37 and 39 - 41 is unpatentable under 35 USC § 103(a) over Pflaumer as modified by Wischermann and further in view of Robinson et al.

GROUPING OF CLAIMS

Pursuant to 37 CFR 1.192(c)(7), appellant requests that the claims be considered as two separate groups as follows:

1. Claims 1, 20 and 35. It is noted that claims 4, 7 - 9 and 23, which have been objected to, are dependent upon a claim in this group.

2. Claims 2, 3, 5 - 7, 12, 21, 22, 24 - 26, 36, 37 and 39 - 41. It is noted that claims 42 - 44, which have been objected to, are dependent upon a claim in this group.

ARGUMENT

I. The Art Rejections

Summary

The combination of references as applied by the USPTO would render the method of the primary reference unfit for its intended purpose.

There is no suggestion or incentive to be found in the references cited to support the obviousness rejections which would place one skilled in the art in possession of the claimed subject matter as is required to properly support the rejections under 35 U.S.C. § 103(a).

Issue (A).

The purposes of the methods of Pflaumer and Wischermann are very different from the purpose of appellant's method. The references, viewed individually or in combination, do not teach or suggest the subject matter recited in claims 1, 20 and 35 (and claims 4, 7 - 9 and 23) within the meaning of 35. U.S.C. § 103(a).

As described previously, the claimed invention is directed to a method and apparatus for selective attenuation of corruption in a digital signal. Corruption can be introduced into a digital signal by the phenomenon known as "aliasing". For a discussion of this phenomenon see page 4, lines 21 -25 of the application. In particular, appellant's method is designed to attenuate aliasing artifacts that occur in digital images captured with a sensor that does not have a suitable anti-aliasing filter. See the discussion extending from page 5, line 12 to page 6, line 5. In appellant's method the output signal is devoid of any aliasing artifacts which were already present in the input signal.

In the method of appellant the resolution of the digital input signal is first reduced to provide a reduced resolution signal that has fewer data samples, or points, than the input signal. The reduced resolution signal is then median filtered, i.e., for any one sample in the reduced resolution signal the median filter computes the median of its neighboring *n* samples and replaces the sample value with the median value, to provide a filtered reduced resolution signal. The filtered reduced resolution signal is then interpolated, that is, the number of data points is increased, to provide the digital output signal. It is important to note that the digital output signal includes all the frequencies of the digital input signal.

As pointed out above it is well known that a median filter is a non-linear filter.

The process of decimation and interpolation reduces the computational complexity involved in the claimed method. See, for example, the discussion on page 17, lines 3 - 14 of the present specification.

Claim Interpretation

The USPTO has in essence asserted that the present claims do not recite the features which are argued as being distinguishing over the prior art. The Office Action states (see page 2) that

> ...a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art.

and that

> ...applicant states only in the preamble to attenuate corruption of an input signal and is not found in the main limitations of the claims, therefore examiner has not given this any weight.

Appellant submits that the USPTO'S interpretation of the claim language is erroneous. The claims, when read in the light of the specification, include the features by which appellant's method, apparatus and multi-resolution filter accomplish the intended purpose and distinguish from the references.

With respect to selective attenuation of corruption in a digital signal, this result is obtained by the method of the invention as claimed. The method claims recite a sequence of steps, including: the step (A) of reducing the resolution of a digital input signal to produce a reduced resolution signal; the step (B) of median filtering the reduced resolution signal, to produce a filtered reduced resolution signal; the step (C) of performing interpolation on the filtered reduced resolution signal to produce the digital output signal. As described in the specification, the digital output signal is devoid of any aliasing artifacts which were present in the digital input signal.

The result obtained according to the method is clearly described in the specification. The terms present in the claimed sequence of steps, when read in light of the specification, must be read as providing the result taught by the specification.

The apparatus claims (see claims 35 and 36 for example) recite corresponding means for carrying out the method steps and the multi-resolution filter claims (see claims 20 and 21 for example) recite a multi-resolution filter including the corresponding filters to carry out the method.

Claims are to be interpreted in light of the specification See *In re Van Geuns,* 988 Fed. 2d 1181, 26 USPQ 2d 1057 (Fed. Cir. 1993). Here, when the claims are interpreted in this manner it is clearly apparent that the claimed method, apparatus and multi-resolution filter

are for the purpose of selectively attenuating, or removing, corruption, or aliasing artifacts, present in a digital input signal.

The Office Action further states, at page 2

> Also applicant is arguing much more than what is being claimed in the claim limitations.

Appellant disagrees with this statement. Appellant has taken a consistent position throughout prosecution of the application, namely that the arguments advanced relate to, and are commensurate in scope with, the method, apparatus and multi-resolution filter recited in the claims.

The teaching of Pflaumer

The method of Pflaumer, as opposed to that of appellant, is aimed at audio signal processing. The key problem to which the method of Pflaumer is directed is distortion which arises in an audio signal from the fact that new frequencies are created above the original Nyquist frequency due to interpolation or up-sampling (see column 2, lines 5 - 18). This is in contrast to the artifacts dealt with in the method of appellant which, as discussed above, arise when the sampling rate of a signal is reduced due to decimation, or down-sampling, without the removal of high frequencies above the Nyquist frequency and these high frequencies "alias" to low frequencies.

It is important to note that Pflaumer is interested in preventing distortion due to interpolation from occurring whereas appellant's method is concerned with removing distortion that has already occurred and is present in the signal.

The method of Pflaumer is generally described at column 3, lines 50 - 57 where it is stated

> [T]he method includes the steps of converting the analog signal to a digital signal using an analog to digital converter, filtering the digital signal using a digital decimation filter having an associated frequency response and subsequently filtering the digital signal through an interpolation filter having an associated frequency response.

Thus, Pflaumer teaches a method wherein an audio signal is decimated, or down-sampled, followed by filtering the reduced resolution signal with a <u>linear</u> filter and subsequently interpolating the filtered signal with a <u>linear</u> filter.

That a linear filter is used in the method of Pflaumer to filter the digital signal is clearly apparent from the characterization of the filter by the patentee as having an associated frequency response. <u>A non-linear filter can not be characterized as having an associated frequency response since it does not have a single, or unique, frequency response; the frequency response of a non-linear filter changes as the signal content changes.</u> Pflaumer is interested in "... attenuating the digital signal in a frequency range

generally corresponding to the transition band portion" (see column 3, lines 60 - 65), which can only be achieved by employing a linear filter.

The bandlimiting filter used in the Pflaumer method is used when reducing the sampling rate from the input format to the output format. The role of the bandlimiting filter is to remove any high frequencies that are present in the input signal and that can not be represented in the lower sampling rate of the output filter. To achieve this result, the bandlimiting filter is necessarily a linear filter since all frequencies outside the cutoff range have to be attenuated by this filter independent of the nature of the input signal.

The linear bandlimiting filter used by Pflaumer is quite unlike the median filter utilized by appellant. As pointed out previously a median filter is a non-linear filter. The non-linearity of the median filter precludes the analysis of this type of filter in the frequency domain. The median filter switches its behavior depending on the input signal. For instance, if a median filter is presented with a step-edge, as illustrated in Fig. 10 of the present application, the output signal is also a step-edge with no degradation. Since, according to the method of appellant, all the frequencies in the input signal are reproduced in the output signal the median filter in this case is not acting as a bandlimiting filter.

The USPTO has acknowledged that the method of Pflaumer does not involve the use of a non-linear filter.

The teaching of Wischermann

To supply the acknowledged missing disclosure of Pflaumer the USPTO has relied upon Wischermann for its teaching of the use of a non-linear filter. The USPTO has concluded that "It would have been obvious to one skilled in the art to combine the teaching of Wischermann to that of Pflaumer because they are analogous in removing aliasing from a signal."(see page 4 of the Office Action) This conclusion is clearly erroneous based on the facts of record.

Wischermann deals with filtering video signals, which are three dimensional signals, to "... suppress disturbing signals which occur most often in video signals that are received from a television broadcast or by reproduction from video tape or other records" (see column 1, line 67 to column 2, line 2). There is described a three dimensional, non-linear filter for this purpose. There is no mention of decimation or down-sampling of the signal. Consequently, there is no possibility of distortion arising due to the reduction of sampling rate of a signal, which is the problem addressed by the applicant's method. Interpolation is mentioned. However, contrary to applicant's method, where the interpolation is applied

after the non-linear filtering, Wischermann's method requires the interpolation be applied before the non-linear filtering (see column 2, lines 50-53 and the description of Figs. 4 and 5 in column 6). Thus, this reference does not in any way teach or suggest the method and apparatus of appellant.

Combining the references in the manner asserted by the USPTO would render the primary reference unfit for its intended purpose

The assertion by the USPTO to the contrary notwithstanding, one skilled in the art would find no motivation or incentive in the teachings of the references to incorporate a non-linear filter in the method of Pflaumer. To do so would render Pflaumer unfit for its intended purpose.

The non-linearity of the median filter utilized by appellant precludes the analysis of this type of filter in the frequency domain. As mentioned previously, the median filter switches its behavior depending on the input signal. For instance, if a median filter is presented with a step-edge, as illustrated in Fig. 10 of the present application, the output signal is also a step-edge with no degradation and no attenuation of any frequency. All the frequencies in the input signal are reproduced in the output signal.

The method of Pflaumer could not achieve its desired result of preventing distortion due to interpolation (see, column 3, lines 41-47) if a median,

or non-linear, filter were to be substituted for the specified linear filter, i.e., a filter having an associated frequency response, since the median filter would not always attenuate the desired frequencies ("... attenuating the digital signal in a frequency range generally corresponding to the transition band portion"; see column 3, lines 63-65). Conversely, if a linear bandlimiting filter were to be substituted for the required median filter in the method and apparatus of appellant, the desired result of attenuating aliasing artifacts in the input signal without degrading the original signal could not be achieved.

Further, to combine the teachings of the references in the manner asserted by the examiner would require taking from the teaching of Wischermann only the use of a non-linear filter completely out of the context in which it is taught. Doing so would take from the secondary reference only so much of its overall disclosure which is necessary to complete the asserted rejection without any consideration of the totality of the entire disclosure.

Such hindsight reconstruction of the prior art to support a rejection under Section 103 is impermissible. Further, as pointed out above, to incorporate a non-linear filter into the method of Pflaumer would render the method of Pflaumer unfit for its stated purpose.

It is evident from the foregoing that there is no suggestion to be found in Wischermann which would

motivate one skilled in the art to utilize a non-linear filter in the method of Pflaumer. Clearly, the combined teachings of these references would not provide to those skilled in the art any suggestion or motivation within the meaning of 35 U.S.C. § 103 to know of appellant's claimed method, apparatus and multi-resolution filter.

Issue (B).

The combined teachings of Pflaumer, Wischermann and Robinson et al. do not teach or suggest the subject matter recited in claims 2, 3, 5 - 7, 12, 21, 22 24 - 26, 24 - 26, 36, 37 and 39 - 41 (including claims 42 - 44) within the meaning of 35. U.S.C. § 103(a).

Claims 2, 3, 5, 6, 12, 21, 22, 24, 25, 36, 37, 39 and 40 are dependent upon a claim in the group discussed above and include all the limitations of the claim(s) from which they depend.

Independent claim 7 is directed to a method, independent claim 26 is directed to a multi-resolution filter and independent claim 41 is directed to an apparatus. These independent claims, as are independent claims 1, 20 and 35, are directed to a method, multi-resolution filter and apparatus for selective attenuation, or removal, of corruption, or aliasing artifacts, in a digital signal.

The claims are patentable for the same reasons discussed in detail above with respect to Pflaumer and

Wischermann and further because the disclosure of Robinson et al. does not teach or suggest the claimed subject matter. Robinson et al. describes a method and apparatus for combining video signals with key signals while maintaining the integrity of the video signal and minimizing the effect of alias components. As is illustrated in Fig. 1, the apparatus includes a low pass filter 13 and a high pass filter 15. An analyzer 16 on the output of the high pass filter detects whether there are any high frequency components which would otherwise cause alias components when the signal is decimated and if such high frequency components are present then low pass filtering occurs whereas if such high frequency components are not present then no unnecessary filtering occurs so as to maintain the integrity of the signal. In essence, the method of this reference utilizes a selective switch based on whether the signal includes components which will provide aliasing.

This reference, like Pflaumer, is therefore concerned with preventing aliasing distortion from occurring in contrast to appellant's claimed method which concerns the removal of aliasing distortion. Furthermore, all low and high pass filters employed by Robinson are linear filters. It should also be noted from Fig. 1 that the order of operations proposed by Robinson is interpolation 10 first, followed by linear filtering 13, followed by decimation 14 whereas appellant's method involves decimation first, followed by non-linear filtering, followed by interpolation.

Those skilled in the art and knowing of the disclosures of these references would not be placed in possession of the presently claimed subject matter.

CONCLUSION

For all of the foregoing reasons the 35 USC § 103 rejections should be reversed and claims 1 - 49 allowed.

Respectfully submitted,

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CLAIMS APPENDIX

I. Claims On Appeal

Claim 1: A method for filtering a digital input signal to produce a digital output signal, the method comprising steps of:

(A) reducing a resolution of the digital input signal to produce a reduced resolution signal;

(B) performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal; and

(C) performing interpolation on the filtered reduced resolution signal to produce the digital output signal.

Claim 2: The method of claim 1, wherein the step (A) comprises steps of:

(A)(1) performing linear filtering on the digital input signal to produce a filtered digital input signal; and

(A)(2) down-sampling the filtered digital input signal to produce the reduced resolution signal.

Claim 3: The method of claim 2, wherein the step (A)(1) comprises a step of performing linear low-pass filtering on the digital input signal.

Claim 5: The method of claim 1, wherein the step (C) comprises steps of:

(C)(1) up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

(C)(2) performing linear low-pass filtering on the up-sampled filtered signal to produce the digital output signal.

Claim 6: The method of claim 5, wherein the step (C)(2) comprises a step of performing low-pass filtering using a linear low-pass filter for use in bi-cubic interpolation to produce the digital output signal.

Claim 7: A method for filtering a digital input signal to produce a digital output signal, the method comprising steps of:

(A) performing linear filtering on the digital input signal to produce a filtered digital input signal;

(B) down-sampling the filtered digital input signal to produce a reduced resolution signal;

(C) performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal;

(D) up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

(E) performing low-pass linear filtering on the up-sampled filtered signal to produce the digital output signal.

Claim 12: The method of claim 1, wherein the digital input signal comprises a two-dimensional signal.

Claim 20: A multi-resolution filter comprising:

a resolution reduction filter to produce a reduced resolution signal by reducing the resolution of a digital input signal;

a median filter to produce a filtered reduced resolution signal by filtering the reduced resolution signal; and

an interpolation filter to produce a digital output signal by interpolating the filtered reduced resolution signal.

Claim 21: The multi-resolution filter of claim 20, wherein the resolution reduction filter comprises:

a linear filter to produce a filtered digital input signal by filtering the digital input signal; and

a down-sampler to produce the reduced resolution signal by down-sampling the filtered digital input signal.

Claim 22: The multi-resolution filter of claim 21, wherein the linear filter comprises a linear low-pass filter.

Claim 24: The multi-resolution filter of claim 20, wherein the interpolation filter comprises:

an up-sampler to produce an up-sampled filtered signal by up-sampling the filtered reduced resolution signal; and

a linear low-pass filter to produce the digital output signal by filtering the up-sampled filtered signal.

Claim 25: The multi-resolution filter of claim 24, wherein the linear low-pass filter comprises a low-pass filter used in bi-cubic interpolation.

Claim 26: A multi-resolution filter for filtering a digital input signal to produce a digital output signal, the multi-resolution filter comprising:

a linear filter to produce a filtered digital input signal by filtering the digital input signal;

a down-sampler to produce the reduced resolution signal by down-sampling the filtered digital input signal;

a median filter to produce a filtered reduced resolution signal by filtering the reduced resolution signal;

an up-sampler to produce an up-sampled filtered signal by up-sampling the filtered reduced resolution signal; and

a linear low-pass filter to produce the digital output signal by filtering the up-sampled filtered signal.

Claim 35: An apparatus for filtering a digital input signal to produce a digital output signal, the apparatus comprising:

resolution reduction means for reducing a resolution of the digital input signal to produce a reduced resolution signal;

median filtering means for performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal; and

interpolation means for performing interpolation on the filtered reduced resolution signal to produce the digital output signal.

Claim 36: The apparatus of claim 35, wherein the resolution reduction means comprises:

means for performing linear filtering on the digital input signal to produce a filtered digital input signal; and

means for down-sampling the filtered digital input signal to produce the reduced resolution signal.

Claim 37: The apparatus of claim 36, wherein the means for performing linear filtering comprises means for performing linear low-pass filtering on the digital input signal.

Claim 39: The apparatus of claim 35, wherein the interpolation means comprises:

up-sampling means for up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

means for performing linear low-pass filtering on the up-sampled filtered signal to produce the digital output signal.

Claim 40: The apparatus of claim 39, wherein the means for performing linear low-pass filtering comprises means for performing low-pass filtering employed in bi-cubic interpolation on the up-sampled filtered signal to produce the digital output signal.

Claim 41: An apparatus for filtering a digital input signal to produce a digital output signal, the apparatus comprising steps of:

means for performing linear filtering on the digital input signal to produce a filtered digital input signal;

means for down-sampling the filtered digital input signal to produce a reduced resolution signal;

means for performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal;

means for up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

means for performing low-pass linear filtering on the up-sampled filtered signal to produce the digital output signal.

II. Claims Allowed

Claim 13: A method for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the method comprising steps of:

(A) filtering the first chrominance signal of the first digital image according to the method of claim 1 to produce the first filtered chrominance signal; and

(B) filtering the second chrominance signal of the first digital image according to the method of claim 1 to produce the second filtered chrominance signal.

Claim 14: The method of claim 13, wherein the first digital image is encoded according to a first color space, and wherein the method further comprises a step of:

(C) converting a third digital image encoded according to a second color space into the first digital image.

Claim 15: The method of claim 14, wherein the first color space comprises a luminance-chrominance

color space, and wherein the second color space comprises an RGB color space.

Claim 16: The method of claim 15, wherein the step (C) comprises steps of:

(C)(1) subtracting a green color signal of the third digital image from a red color signal of the third digital image to produce the first chrominance signal of the first digital image;

(C)(2) subtracting the green color signal of the third digital image from a blue color signal of the third digital image to produce the second chrominance signal of the first digital image; and

(C)(3) providing the green color signal as the luminance signal of the first digital image.

Claim 17: The method of claim 14, further comprising a step of:

(D) converting the second digital image into a fourth digital image encoded according to a third color space.

Claim 18: The method of claim 17, wherein the first color space comprises a luminance-chrominance color space, and wherein the third color space comprises an RGB color space.

Claim 19: The method of claim 18, wherein the step (D) comprises steps of:

(D)(1) adding the first filtered chrominance signal to the luminance signal to produce a red color signal of the fourth digital image;

(D)(2) adding the second filtered chrominance signal to the luminance signal to produce a blue color signal of the fourth digital image; and

(D)(3) providing the luminance signal as a green color signal of the fourth digital image.

Claim 30: A multi-resolution filtering system for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the multi-resolution filtering system comprising:

a first multi-resolution filter according to claim 20 to produce the first filtered chrominance signal by filtering the first chrominance signal of the first digital image; and

a second multi-resolution filter according to claim 20 to produce the second filtered chrominance signal by filtering the second chrominance signal of the first digital image.

Claim 31: The multi-resolution filtering system of claim 30, wherein the first digital image is encoded according to a first color space, and wherein the multi-resolution filtering system further comprises:

a first color converter to convert a third digital image encoded according to a second color space into the first digital image.

Claim 32: The multi-resolution filtering system of claim 31, wherein the first color converter comprises:

a first subtractor to develop the first chrominance signal by subtracting a green color signal of the third digital image from a red color signal of the third digital image; and

a second subtractor to develop the second chrominance signal by subtracting the green color signal of the third digital image from a blue color signal of the third digital image.

Claim 33: The multi-resolution filtering system of claim 31, further comprising:

a second color converter to convert the second digital image into a fourth digital image encoded according to a third color space.

Claim 34: The multi-resolution filtering system of claim 33, wherein the second color converter comprises:

a first adder to develop a red color signal of the fourth digital image by adding the first filtered chrominance signal to the luminance signal of the second digital image; and

a second adder to develop a blue color signal of the fourth digital image by adding the second filtered chrominance signal to the luminance signal of the second digital image.

Claim 45: An apparatus for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the apparatus comprising:

means for filtering the first chrominance signal of the first digital image according to the method of claim 1 to produce the first filtered chrominance signal; and

means for filtering the second chrominance signal of the first digital image according to the method of claim 1 to produce the second filtered chrominance signal.

Claim 46: The apparatus of claim 45, wherein the first digital image is encoded according to a first color space, and wherein the apparatus further comprises:

means for converting a third digital image encoded according to a second color space into the first digital image.

Claim 47: The apparatus of claim 46, wherein the means for converting comprises:

means for subtracting a green color signal of the third digital image from a red color signal of the third digital image to produce the first chrominance signal;

means for subtracting the green color signal of the third digital image from a blue color signal of the third digital image to produce the second chrominance signal; and

means for providing the green color signal as the luminance signal.

Claim 48: The apparatus of claim 45, further comprising:

means for converting the second digital image into a fourth digital image encoded according to a third color space.

Claim 49: The apparatus of claim 48, wherein the means for converting comprises:

means for adding the first filtered chrominance signal to the luminance signal of the second digital image to produce a red color signal of the fourth digital image;

means for adding the second filtered chrominance signal to the luminance signal of the second digital image to produce a blue color signal of the fourth digital image; and

means for providing the luminance signal of the second digital image as a green color signal of the fourth digital image.

III. Claims Objected To

Claim 4: The method of claim 3, wherein the step of performing linear low-pass filtering on the digital input signal comprises a step of performing mean filtering on the digital input signal.

Claim 8: The method of claim 7, wherein the step (B) comprises a step of:

(B)(1) down-sampling the filtered digital input signal by a down-sampling factor to produce the reduced resolution signal;

wherein the step (D) comprises a step of:

(D)(1) up-sampling the filtered reduced resolution signal by an up-sampling factor to produce the up-sampled filtered signal; and

wherein the up-sampling factor and the down-sampling factor are equal.

Claim 9: The method of claim 8, wherein the step (A) comprises a step of:

(A) performing linear filtering with a rectangular impulse response of length *dec* on the digital input signal to produce the filtered digital input signal; and

wherein *dec* is equal to the down-sampling factor and to the up-sampling factor.

Claim 10: The method of claim 9, wherein the step (E) comprises a step of:

(E)(1) performing low-pass linear filtering with a support of length *dec* on the up-sampled filtered signal to produce the digital output signal.

Claim 11: The method of claim 1, wherein the digital input signal comprises a signal corresponding to a chrominance channel of a digital image.

Claim 23: The multi-resolution filter of claim 22, wherein the linear low-pass filter comprises a mean filter.

Claim 27: The multi-resolution filter of claim 26, wherein the down-sampler has a down-sampling factor that is equal to an up-sampling factor of the up-sampler.

Claim 28: The multi-resolution filter of claim 27, wherein the linear filter has a support that is equal to the down-sampling factor and the up-sampling factor.

Claim 29: The multi-resolution filter of claim 28, wherein the linear low-pass filter has a support that is equal to the down-sampling factor and the up-sampling factor.

Claim 38: The apparatus of claim 37, wherein the means for performing linear low-pass filtering comprises means for performing mean filtering on the digital input signal.

Claim 42: The apparatus of claim 41, wherein the means for down-sampling comprises means for down-sampling the filtered digital input signal by a down-sampling factor to produce the reduced resolution signal, wherein the means for up-sampling comprises means for up-sampling the filtered reduced resolution signal by an up-sampling factor to produce the up-sampled filtered signal, and wherein the up-sampling factor and the down-sampling factor are equal.

Claim 43: The apparatus of claim 42, wherein the means for performing linear filtering comprises means for performing linear filtering with a rectangular impulse response of length *dec* on the digital input signal to produce the filtered digital input signal, and wherein *dec* is equal to the down-sampling factor and to the up-sampling factor.

Claim 44: The apparatus of claim 43, wherein the means for performing low-pass linear filtering comprises means for performing low-pass linear filtering with a support of length *dec* on the up-sampled filtered signal to produce the digital output signal.

EVIDENCE APPENDIX

Appellant has not submitted in the application any evidence pursuant to §§ 1.130, 1.131 and 1.132 of 37 Code of Federal regulations.

RELATED PROCEEDINGS APPENDIX

There are no decisions by a court or the Board of Patent Appeals and Interferences in any related proceedings.

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: March 3, 2006

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